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(54) Abstract Title

**Ink jet printing process**

(57) There is described a method of improving the resistance to wet-rub of a pigment based ink which has been jetted on to a receiver which comprises coating or over printing at least the inked areas of the receiver with an aqueous solution of a styrene acrylate resin.

Preferably the whole surface of the receiver is coated with the styrene acrylate resin.

There is also described a method of coating the receiver by over printing using a further nozzle of the ink jet printer to lay down the aqueous solution of the styrene acrylate resin.

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This invention relates to the treatment of images prepared by an ink-jet printing process. Most ink-jet printers use water based inks and the colour used therein may be a dye or a pigment.

When the colouring material is a dye usually the dye penetrates through the top layer of the printing sheet and diffuses into an underlayer. However if the ink colourant is a pigment the pigment is often unable to penetrate the top surface of the printing sheet. Sometimes the top layer of the printing sheet exerts an adhesion effect on the pigment particles in the ink and this inhibits the pigment particles being rubbed off by dry rubbing. If however the sheet is subjected to wet rubbing the pigment particles will often rub off leaving a smeared image.

Therefore according to the present invention there is provided a method of improving the resistance to wet-rub of a pigment based ink which has been jetted on to a receiver which comprises coating or over-printing at least the inked areas of the receiver with an aqueous solution of a styrene acrylate resin at a coating weight of from 0.1 gram per square meter.

Preferably the whole inked surface of the receiver is coated or over-printed with the styrene acrylate resin

Preferably the ink-jet printer prints onto a receiver the requisite coloured pigment ink or inks and after these inks have been laid down on the receiver a further nozzle of the printer lays down the aqueous solution of the styrene acrylate resin.

Preferably a 5 - 30 % by weight aqueous solution of styrene acrylate is coated on the receiver.

Preferably the coating weight of styrene acrylate is from 0.5 to 5.0gsm.

The substrate may be any of the paper based media typically used for ink-jet printing , including for example coated or uncoated papers or high wet-strength paper. The invention can also be applied to other media incorporating appropriate ink receiving layers such as the coated vinyls, transparency materials or synthetic papers.

The styrene acrylate is preferably coated or over-printed from an alkaline solution e.g. with ammonia or sodium hydroxide present. Preferably it is coated or over-printed at room temperature via either a K-bar coating apparatus or an appropriate ink-jet nozzle, respectively.

Pigmented inks often comprise from 2 to 10% by weight of a coloured or black pigment, around 2 - 5 % by weight of a dispersing or wetting agent and preferably from 5 to 30 % by weight of a combination of additives such as humectants and penetrants, including e.g. ethylene glycol, diethylene glycol or urea, the remainder being water.

The following Example, where all the prints were made using pigmented inks, will serve to illustrate the invention:

On to sheets of a white wet strength paper there was printed a pigmented ink of the following formulation:-

5% by weight of a magenta pigment

2% by weight of a dispersing agent

10% by weight of diethylene glycol

83% by weight water

- to give samples having a maximum print density in the region of 1.5. The printing was carried out at room temperature using a conventional thermal Drop-on-Demand ink-jet printer.

These provide Comparative Samples A

A second set of samples was prepared as above and after drying, these were coated with a solution of the following formulation:-

10% by weight of a styrene acrylate polymer

0.5% by weight of ammonia

89.5% by weight water

- to give a coating weight of the polymer of 5 gsm. The polymer solutions were coated onto the paper at room temperature using a K-bar coating apparatus.

These provide sample set B, which illustrate the invention.

A third sample was printed with the pigmented ink as set forth above and after drying, was coated with an aqueous solution of a polymer other than the styrene acrylate.

This provides Comparative Sample C.

All the printed samples were subjected to a wet rub test involving wiping across the printed area with a dampened lint-free tissue. The appearance of any transfer of ink from the printed area to an unprinted portion of the sample was noted and the "wet rub" performance of the sample was classified according to the degree of transfer of colour observed.

The findings are presented in the Table below :-

Table - Wet Rub Performance of Print Samples

Sample	Polymer Over-coat	Mol.Wt.	Wet Rub Performance
Comparative Sample - A	None	-	Poor
Invention Sample - B1	Styrene Acrylate	1,800	Excellent
" " - B2	" "	8,500	"
" " - B3	" "	15,500	"
" " - B4	" "	>200,000	"
Comparative Sample - C	Polystyrene Sulphonate	-	Poor

From this, the improved wet rub resistance of the samples of the invention over the comparative samples printed in the absence of an over-coat or in the presence of an over-coat comprising an alternative polymer additive, are clear.

In addition, samples A and B3 were tested for "spongeability", in accordance with BS 1248 part 2 1990/E N 233 1989. The results of the test were as follows :-

Sample A exhibited smudging of ink when tested but sample B3 did not. This again shows that the addition of an over-coat incorporating the styrene acrylate polymer had improved resistance to wet rub.

#### CLAIMS :-

1. A method of improving the resistance to wet-rub of a pigment based ink which has been jetted on to a receiver which comprises coating at least the inked areas of the receiver with an aqueous solution of a styrene acrylate resin at a coating weight of from 0.1 gram per square meter.
2. A method according to claim 1 wherein the whole inked surface of the receiver is coated with the styrene acrylate resin.
3. A method according to claim 1 wherein an ink-jet printer prints onto a receiver the requisite coloured pigment ink or inks and after these inks have been laid down on the receiver a further nozzle of the printer lays down the aqueous solution of the styrene acrylate resin.
4. A method according to any one of claims 1,2 or 3 wherein a 10% by weight aqueous solution of styrene acrylate is coated on the receiver.
5. A method according to any one of claims 1,2,3 or 4 wherein the coating weight of the styrene acrylate is from 0.5 to 5.0 gsm.

## CLAIMS :-

1. A method of improving the resistance to wet-rub of an aqueous pigment based ink jet ink which has been jetted on to a receiver which comprises coating at least the inked areas of the receiver with an aqueous solution of a styrene acrylate polymer at a coating weight of from 0.1 gram per square metre.
2. A method according to claim 1 wherein the whole inked surface of the receiver is coated with the styrene acrylate polymer.
3. A method according to claim 1 wherein an ink-jet printer prints onto a receiver the requisite coloured pigment ink or inks and after these inks have been laid down on the receiver a further nozzle of the ink jet printer lays down the aqueous solution of the styrene acrylate polymer.
4. A method according to any one of claims 1,2 or 3 wherein a 10% by weight aqueous solution of styrene acrylate polymer is coated on the receiver.
5. A method according to any one of claims 1,2,3 or 4 wherein the coating weight of the styrene acrylate polymer is from 0.5 to 5.0 gsm.